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ABSTRACT

In an effort to develop and evaluate simulation programs for educational administrators, two groups of either practicing or preparing administrators underwent different simulation programs to investigate differences in physiological activity. The simulation process was a small office and screen where either a static or dynamic program depicting a "problem day in the life of a principal" was shown. Each participant had a reading of his galvanic skin potential and heart rate taken before, in process, and after the simulation session. The before and after readings were combined into the base rate of the individual. The study sought to find significant differences in physiological activity between the two groups and between the in process and base rate readings. Utilizing galvanic skin potential frequency scores, no significant differences were found; but when the ratio of the galvanic skin potential amplitude and frequency scores were taken, there were significant differences both between groups and within individuals. In addition, the heart rate activity was significantly different between groups and within individuals. (WH)

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The Effects of Static and Dynamic Simulation Programs On the Physiological Activity of Educational Administrators.*

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Introduction

Neophyte educational administrators often have had difficulty transferring their knowledge of theoretical administrative behavior into practice. A possible explanation for this difficulty was that there has been little opportunity for a student to systematically practice his administrative skills. Similar types of limitations have been successfully resolved in business, industry and military through the use of simulation techniques.

It was apparent from the review of the literature that few studies have systematically investigated the relationship between the mode of simulation program presentation and the on-going participant involvement. Proponents of the simulation technique often implied that involvement is one, if not the fundamental characteristic that resulted in participant learning (Beck & Monroe, 1969; Cruickshank & Broadbent, 1968; Twelker, 1969a). It follows that if involvement was generally inherent in simulation participants, this would be demonstrated by their physiological reactions during the simulation experience.

Purpose of the Study

This study was conducted to develop and evaluate static and dynamic simulated programs and determine their effects on the galvanic skin potential and heart rate activity of practicing educational administrators and/or educational administrators in training at Bowling Green State University.

Research Hypotheses

1. There is no significant difference between the mean overall activity of the galvanic skin potential (GSP) of educational administrators receiving the static simulated program from those receiving the dynamic program.
2. There is no significant difference between the mean overall heart rate activity (HRA) of educational administrators receiving the static simulated program from those receiving the dynamic program.
3. Educational administrators who experience the static simulated educational program will evidence a significantly greater mean overall activity of GSP than their no experience base rate.
4. Educational administrators who experience the static simulated educational program will evidence a significantly greater mean overall HRA than their no experience base rate.
5. Educational administrators who experience the dynamic simulated educational program will evidence a significantly greater mean overall activity of GSP than their no experience base rate.
6. Educational administrators who experience the dynamic simulated educational program will evidence a significantly greater mean overall activity of HRA than their no experience base rate.

Overview of Procedures

Static and dynamic visual programs were developed that evolved

around a "problem day in the life of a principal". Concurrently, a portable simulated environment was designed and constructed to resemble a small administrative office. One wall of the office contained a rear projection screen where the simulated programs were projected. The participants were individually seated inside the office at a desk where they faced the screen.

This study employed two groups to obtain the necessary data to test the hypotheses. One group was subjected to the dynamic presentation and the other group underwent the static program. During both simulations the participant's physiological responses were continuously monitored and recorded, as well as base rates before and after the simulation program. A mean average of both the HRA and the GSP served as the final criterion. The ultimate test of the problem was pursued through statistical comparisons of the mean scores.

Analysis of the Data

A Bowling Green State University computer consultant wrote a program that calculated a simulation experience mean from each raw data card and punched this information onto a separate card (two GSP cards and one HRA card were generated for each participant). In addition, pre and post base rate data were also punched onto separate cards.

The means for hypothesis one and two were both analyzed by utilizing the Bowling Green State University Statistical Package Program entitled t-test Between Means. This program computes means, standard deviations and performs t-tests or the difference between uncorrelated means in two different groups. The number of subjects does not have to be equal in the two groups.

Hypothesis three, four, five and six were analyzed by using a different program from the university's statistical package. This program is entitled t-test for the Difference Between Paired Variates. It accepts data and computes means, standard deviations and performs t-tests on the difference between correlated means (between the means of two variables measured on the same sample).

Research Hypothesis I.

The first hypothesis stated that there was no significant difference in the mean GSP activity of subjects during the static simulation program from that of subjects in the dynamic simulation program. Table 1 summarizes the comparison.

TABLE 1

TWO TAILED UNCORRELATED 't' TESTS OF SIGNIFICANCE BETWEEN THE MEAN BASE LEVEL GSP ACTIVITY OF THE TWO EXPERIMENTAL GROUPS

UTILIZING GSP FREQUENCY AS THE CRITERION

GROUPS	N	X	$\overline{X}$	X^2
Static (Slides)	33	220.55	6.68	1771.71
Dynamic (Film)	46	344.40	7.49	2901.03

df = 78 t = 1.24 ($p > .05$)

UTILIZING GSP AMPLITUDE DIVIDED BY GSP FREQUENCY AS THE CRITERION

GROUPS	N	X	$\overline{X}$	X^2
Static (Slides)	33	270.50	8.20	2824.59
Dynamic (Film)	46	268.96	5.85	1971.13

df = 78 t = 2.85 ($p < .01$)

The GSP tracings were read and converted into two forms of interval data, the first being strictly the GSP frequency response and the second being the GSP amplitude divided by GSP frequency. The 't' test of significance utilizing the GSP frequency data showed no significant difference ($p > .05$) between mean scores of the static and dynamic simulation groups. This statistical analysis indicated that the static and dynamic simulation program aroused the participants similarly in terms of frequency. However, a significant difference

($p < .01$) was found between the groups when the GSP amplitude divided by GSP frequency data was used. Apparently the static simulation program was able to induce a higher level of GSP amplitude as a factor of frequency than the dynamic presentation. Because of this inconsistency in GSP measures, data for Hypothesis I was inconclusive.

Research Hypothesis II.

The second hypothesis stated that there was no significant difference in the mean HRA of subjects during the static simulation program from that of subjects in the dynamic simulation program. The uncorrelated 't' tests of significance exhibited no significant difference between the two groups when it was applied to the two sample means. The null hypothesis was tentatively accepted. There was no significant difference in the mean HRA of the subjects receiving the dynamic and the static simulation programs. Table 2 contains the data pertinent to this test.

TABLE 2

TWO TAILED UNCORRELATED 't' TESTS OF SIGNIFICANCE BETWEEN THE MEAN BASE LEVEL HEART RATE ACTIVITY OF THE TWO EXPERIMENTAL GROUPS

GROUPS	N	X	$\overline{X}$	X^2
Static (Slide)	33	2640.48	80.01	215318.56
Dynamic (Film)	46	3602.20	78.31	288355.13

df = 78 t - .65 ($p > .05$)

Research Hypothesis III.

Predicting a significantly greater GSP activity among subjects while participating in the static simulation program over their no experience base rate was the essence of the third hypothesis. Utilizing the GSP frequency mean data, no significant difference ($p < .05$) was found between the base line and in-process means. Utilizing the GSP amplitude divided by GSP frequency data, the in-process group had significantly higher ($p < .0005$) GSP activity than their base rate readings. The data for these one tailed 't' tests of significance are found in Table 3.

TABLE 3

ONE TAILED UNCORRELATED 't' TESTS OF SIGNIFICANCE BETWEEN THE NO EXPERIENCE MEAN BASE RATE AND THE IN-PROCESS OVERALL GSP ACTIVITY

UTILIZING GSP FREQUENCY AS THE CRITERION

	N	X	$\bar{X}$	X^2
In-Process Data	33	220.55	6.68	1771.71
Base Rate Data	33	206.00	6.24	1664.00
Differences	33	14.55	.44	259.79

df = 32 t = .90 ($p > .05$)

UTILIZING GSP AMPLITUDE DIVIDED BY FREQUENCY AS THE CRITERION

	N	X	$\bar{X}$	X^2
In-Process Data	33	270.50	8.20	2824.59

	N	X	$\bar{X}$	X^2
Base Rate Data	33	161.57	4.90	1254.76
Differences	33	108.93	3.30	990.47

df = 32 t = 4.27 ($p < .0005$)

The intent, as outlined in the data scoring section of chapter three, was to utilize two formidable indices of GSP. The assumption

underlying the comparison of the first base rate frequency response to the in-process simulation was that the base rates would in fact be an index of normal non-stimulated GSP measures. It is believed that the novelty of the simulated office environment and the participants' general uncertainty of the forthcoming experiment culminated in an inflated GSP pre-simulation base rate. A comparison of the pre and post GSP frequency base rates presented empirical evidence to support this position. When the in-process static simulation means were compared to the post-base rate data, a significant difference ($p < .005$) was found. Further evidence was generated by computing an average base rate mean. A significantly greater ($p < .01$) GSP frequency response was also found during the in-process simulation than their average base rate data.

Because of this pre-simulation base rate discrepancy, it is assumed that the amplitude divided by the frequency indice is the more valid index. The GSP amplitude, even as a factor of frequency, remained significant (regardless of a false increase in base line data) due to the magnitude of arousal level stimulus found in the simulation program. Therefore, the directional hypothesis was tentatively accepted.

Research Hypothesis IV.

The fourth hypothesis hypothesized that the mean HRA of subjects while experiencing the simulated program would be significantly higher than their no experience base rate. It was found that the in-process HRA was significantly ($p < .005$) greater than the same group's base rate mean. Table 4 contains the computations for this

statistical test. The research hypothesis was tentatively accepted and it is therefore assumed that the static simulation program caused a significant increase in HRA than the no experience base rate.

TABLE 4

ONE TAILED CORRELATED 't' TEST OF SIGNIFICANCE BETWEEN THE NO EXPERIENCE BASE RATE AND THE IN-PROCESS OVERALL HEART RATE ACTIVITY OF SUBJECTS EXPERIENCING THE STATIC PRESENTATION

	N	X	$\overline{X}$	X^2
In-Process Data	33	2640.48	80.01	215318.50
Base Rate Data	33	2507.00	75.97	193751.00
Difference	33	133.48	4.04	2618.56

df = 32 t = 2.88 ($p < .005$)

Research Hypothesis V.

The last two hypothesis concerned themselves with the dynamic simulation program that utilized a film presentation and its effect on the GSP and HRA of subjects as compared to their base rates. Hypothesis V predicted a significant increase in subject GSP while experiencing the simulation program.

Table 5 summarizes both forms of GSP data comparisons between the base line means and the in-process means.

TABLE 5

ONE TAILED CORRELATED 't' TEST OF SIGNIFICANCE BETWEEN THE NO EXPERIENCE BASE RATE AND THE IN-PROCESS OVERALL GSP ACTIVITY OF SUBJECTS EXPERIENCING THE DYNAMIC PRESENTATION

UTILIZING GSP FREQUENCY AS THE CRITERION

	N	X	$\overline{X}$	X^2
In-Process Data	46	344.40	7.49	2901.08
Base Rate Data	46	330.00	7.17	3026.00
Difference	46	14.40	.31	389.46

df = 45 t = .73 ($p > .05$)

UTILIZING GSP AMPLITUDE DIVIDED BY FREQUENCY AS THE CRITERION

	N	X	$\overline{X}$	X^2
In-Process Data	46	268.96	5.85	1971.13
	N	X	$\overline{X}$	X^2
Base Rate Data	46	197.52	4.29	1290.96
Difference	46	71.44	1.55	585.65

df = 45 t = 3.24 ($p < .005$)

No significant difference ($p > .05$) was found between the straight GSP frequency base rates and in-process means among subjects who participated in the dynamic simulation group. However, when the GSP amplitude divided by frequency means were compared, a significant difference ($p < .005$) was found.

Unfortunately, the same base rate inflation that plaqued hypothesis three also effected the frequency response t-test values in hypothesis five. An examination of the pre and post base rates presented evidence to support this notion. When the in-process dynamic simulation means were compared to the post-base rate data, a significant difference ($p < .0005$) was found. Further support was generated by computing an average base rate mean. A significantly higher ($p < .01$) GSP frequency response was also found during the in-process simulation than their average base rate frequency response data (See Appendix H for t-test tables). Hence, it is assumed that the amplitude divided by the frequency was again the more accurate GSP measure and the directional hypothesis was tentatively accepted.

Research Hypothesis VI.

The sixth hypothesis stated that the in-process HRA mean of the subjects would be significantly higher than the HRA base line mean of the same group. This hypothesis was accepted in that there was a significant difference ($p < .0005$) and the findings are presented in Table 6.

TABLE 6

ONE TAILED CORRELATED 't' TEST OF SIGNIFICANCE BETWEEN THE NO EXPERIENCE BASE RATE AND THE IN-PROCESS OVERALL HEART RATE ACTIVITY OF SUBJECTS EXPERIENCING THE DYNAMIC PRESENTATION

	N	X	$\overline{X}$	X^2
In-Process Data	46	3602.21	78.31	288355.25
Base Rate Data	46	3487.00	75.80	270903.00
Difference	46	115.21	2.50	1129.55

df = 45 t = 3.93 ($p < .0005$)

A significant increase in HRA was attributed to experiencing the dynamic simulation program.

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